

REMARKS

I. Introduction

In response to the Office Action dated October 4, 2004, Applicants have canceled claims 12-14, without prejudice or disclaimer. Also, Applicants have amended claim 11 so as to further clarify the claimed subject matter. New claims 28-30 are added. Support for these amendments can be found, for example, in Figs. 2A and 2C, and their corresponding sections of the specification. No new matter has been added.

For the reasons set forth below, Applicants respectfully submit that all pending claims are patentable over the cited prior art references.

II. The Rejection Of Claims 11 and 26 Under 35 U.S.C. § 103

Claims 11 and 26 are rejected under 35 U.S.C. § 103 as being unpatentable over USP No. 4,830,984 to Purdes in view of USP No. 5,753,551 to Sung or USP No. 6,110,811 to Pey. Applicants respectfully traverse this rejection for at least the following reasons.

Claim 11, as amended, recites an epitaxial growth method comprising growing an epitaxial layer on a layered substrate, wherein the layered substrate comprises sapphire on silicon and the epitaxial layer comprises group III nitrides.

In accordance with one exemplary embodiment of the present invention, the silicon 212 is grown on one side of the sapphire substrate 210 by chemical vapor deposition, while a GaN, InGaAlN, InGaN or AlGaN alloy-based device layer 214 is formed on the other side of the substrate 210 by metal organic chemical vapor deposition (see, e.g., page 10, lines 6-20 of the specification). As a result, the present invention advantageously provides a flat wafer after the growth of the epitaxial layer.

Turning to the cited prior art, Purdes discloses forming a tensioning material 22, such as metal silicide, tungsten silicide or titanium silicide, on the bottom or second side of the silicon substrate 20 to counteract the tensioning force and warping effect caused by the gallium arsenide layer 24 placed on the top or first side of the silicon substrate 20 (see, col. 3, lines 18-26 and col. 4, lines 3-5). However, at a minimum, Purdes is silent with regard to providing a group III nitride layer on the silicon substrate comprising sapphire on silicon. Indeed, Purdes only discloses counteracting the tensioning force caused by the gallium arsenide layer 24, and does not disclose or suggest providing a group III nitride layer on the silicon substrate comprising sapphire on silicon. On the other hand, Sung merely discloses forming the photoresist 4 on the silicon oxide layer 3 provided on the silicon substrate 1 (see, Fig. 3A), and Pey only discloses depositing a layer of titanium 22 over the silicon substrate 10 (see, Fig. 3). Hence, Sung and Pey also do not cure the foregoing defects of Purdes. Thus, Purdes, Sung and Pey, taken alone or in combination, do not disclose or suggest all of the claim elements recited by amended claim 11.

Accordingly, as each and every limitation must be either disclosed or suggested by the cited prior art in order to establish a *prima facie* case of obviousness (see, **M.P.E.P. § 2143.03**), and Purdes, Sung and Pey, taken alone or in combination, fail to do so, it is respectfully submitted that claim 11 is patentable over the prior art.

III. The Rejection Of Claims 11, 13-14 and 24-26 Under 35 U.S.C. § 103

Claims 11, 13-14 and 24-26 are rejected under 35 U.S.C. § 103 as being unpatentable over USP No. 5,562,770 to Chen in view of USP No. 6,086,673 to Molnar and USP No. 4,395,438 to Chiang. Applicants respectfully traverse this rejection for at least the following reasons.

Claim 11, as amended, recites an epitaxial growth method comprising growing an epitaxial layer on a layered substrate, wherein the layered substrate comprises sapphire on silicon and the epitaxial layer comprises group III nitrides.

In accordance with one exemplary embodiment of the present invention, the silicon 212 is grown on one side of the sapphire substrate 210 by chemical vapor deposition, while a GaN, InGaAlN, InGaN or AlGaIn alloy-based device layer 214 is formed on the other side of the substrate 210 by metal organic chemical vapor deposition (see, e.g., page 10, lines 6-20 of the specification). As a result, the present invention advantageously provides a flat wafer after the growth of the epitaxial layer.

Turning to the cited prior art, Chen discloses forming a device layer 150 on top of the substrate 140, and placing a film 160 at the bottom of the substrate 140. However, at a minimum, Chen does not disclose or suggest that the substrate 140 is a sapphire on silicon layered substrate. In contrast, Chen discloses that the film deposited on the backside (i.e., bottom) is selected from a group consisting of silicon dioxide, silicon nitride, silicon oxynitride and aluminum oxide (see, col. 10, lines 30-32), and does not disclose or suggest that the substrate 140 is a layered substrate comprising sapphire on silicon.

Further, similar to the conventional method disclosed in the specification (see, e.g., page 7, lines 11-16 of the specification), Molnar discloses utilizing sapphire as the nitride growth substrate due to its low cost, high quality, large substrate diameter, chemical inertness and chemical compatibility with nitride in the GaN growth process (see, col. 7, lines 19-24). As such, Molnar is also silent with regard to providing a sapphire-on-silicon layered substrate for reducing any bowing or warping effect. Finally, Chiang does not appear to even discuss the problem recognized by the present invention related to bowing, let alone providing a motivation or modifying the substrate 41

into a sapphire-on-silicon layered substrate so as to obtain a flat wafer.

Thus, at a minimum, Chen, Molnar and Chiang, taken alone or in combination, do not disclose or suggest the claim elements recited by amended claim 11.

Accordingly, as each and every limitation must be either disclosed or suggested by the cited prior art in order to establish a *prima facie* case of obviousness (see, **M.P.E.P. § 2143.03**), and Chen, Molnar and Chiang, taken alone or in combination, fail to do so, it is respectfully submitted that claim 11 is patentable over the prior art.

IV. The Rejection Of Claims 11, 13-14 and 24-26 Under 35 U.S.C. § 103

Claims 11, 13-14 and 24-26 are rejected under 35 U.S.C. § 103 as being unpatentable over Molnar in view of Purdes and Sung. However, for at least the reasons discussed above, Molnar discloses employing various foreign substrates including sapphire, spinel, silicon carbide, silicon, YAG, GGG, gallium arsenide, titanium nitride, titanium carbide, ScN, InN, AlN, InGaAlAs, InGaAlP, InGaAsP, InGaAlN or combinations of these materials. However, as acknowledged by the Examiner, Molnar is silent with regard to growing an epitaxial layer on a layered substrate so as to reduce bowing (see, page 7 of Office Action), let alone utilizing a sapphire-on-silicon substrate for reducing such bowing. Purdes and Sung also do not cure this defect of Molnar. Thus, Molnar, Purdes and Sung, taken alone or in combination, do not disclose or suggest the claim elements recited by amended claim 11.

Accordingly, as each and every limitation must be either disclosed or suggested by the cited prior art in order to establish a *prima facie* case of obviousness (see, **M.P.E.P. § 2143.03**), and Molnar, Purdes and Sung, taken alone or in combination, fail to do so, it is respectfully submitted that claim 11 is patentable over the prior art.

V. **All Dependent Claims Are Allowable Because The Independent Claims From Which They Depend Are Allowable**

Under Federal Circuit guidelines, a dependent claim is nonobvious if the independent claim upon which it depends is allowable because all the limitations of the independent claim are contained in the dependent claims, *Hartness International Inc. v. Simplimatic Engineering Co.*, 819 F.2d at 1100, 1108 (Fed. Cir. 1987). Accordingly, as independent claim 11 is patentable for the reasons set forth above, it is respectfully submitted that all claims dependent thereon are also in condition for allowance.

For all of the foregoing reasons, it is submitted that dependent claims 24-26 are patentable over the cited prior art. Accordingly, it is respectfully submitted that the rejections of claims 11 and 24-26 under 35 U.S.C. § 103 have been overcome.

Furthermore, new claims 28-30 depend on claim 11, and hence, distinguish over the prior art for reasons previously argued with respect to claim 11. Thus, the patentability of claims 28-30 are respectfully advocated based upon the limitations expressed therein.

VI. **Conclusion**

Accordingly, it is urged that the application is in condition for allowance, an indication of which is respectfully solicited.

If there are any outstanding issues that might be resolved by an interview or an Examiner's amendment, the Examiner is requested to call Applicants' attorney at the telephone number shown below.

Application No.: 09/904,131

To the extent necessary, a petition for an extension of time under 37 C.F.R. § 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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